Supporting Information

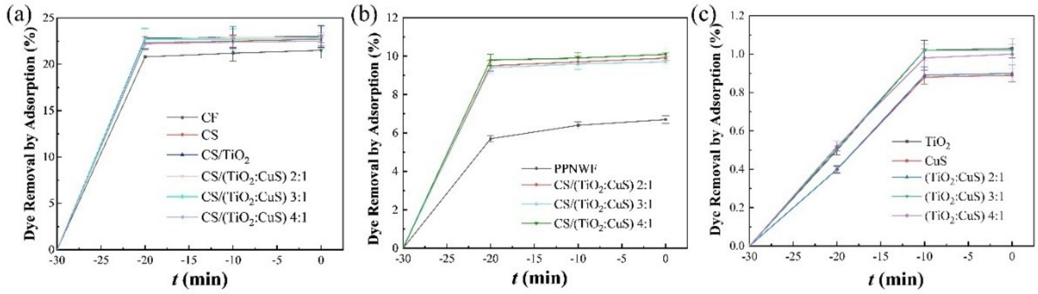

Figure S1. Adsorption-desorption equilibrium curves. (a) Equilibrium curves for CF, CS-CF, CS/TiO_2-CF, and CF loaded with heterojunctions of three molar ratios. (b) Adsorption equilibrium curves for PPNWF and PPNWF loaded with heterojunctions of three molar ratios. (c) Adsorption equilibrium curves for TiO_2, CuS, and heterojunctions of three molar ratios.

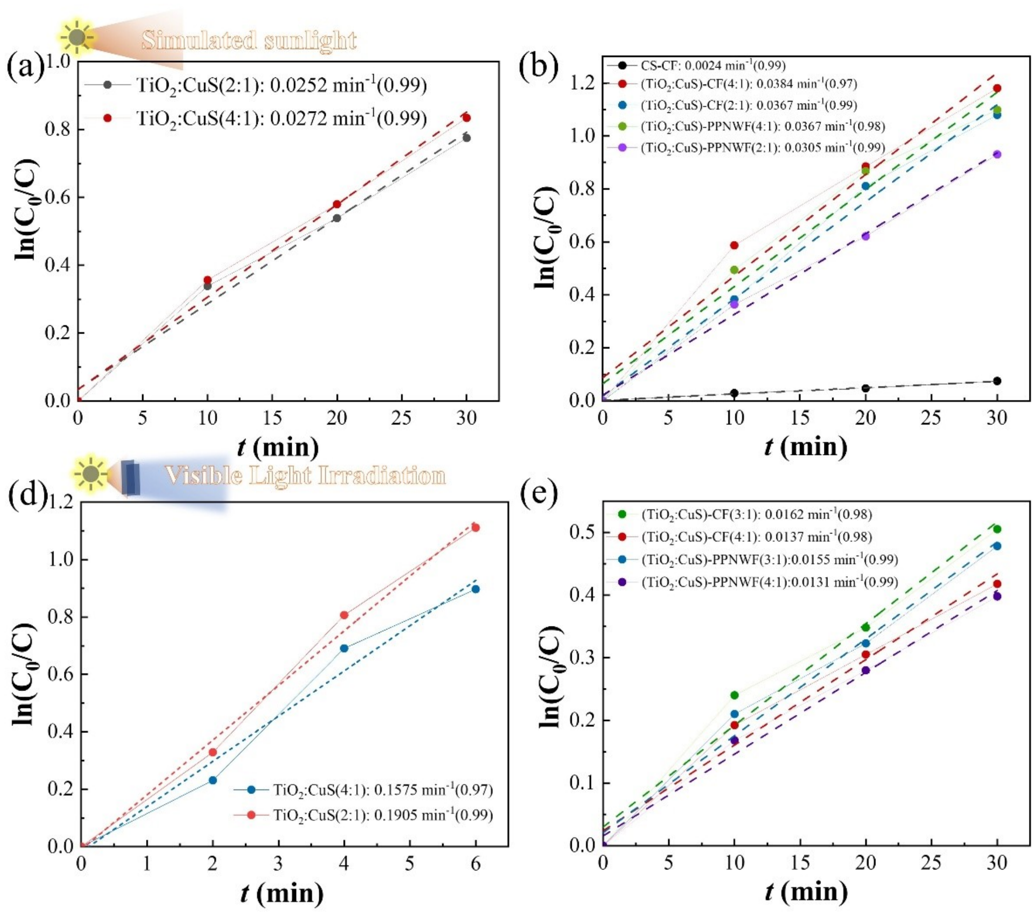

Figure S2. Pseudo-first-order kinetics plots. (a) Plots for TiO_2/CuS heterojunctions with 2:1 and 4:1 molar ratios under simulated sunlight irradiation. (b) Plots for TiO_2/CuS heterojunction-CF (2:1 and 4:1), TiO_2/CuS heterojunction-PPNWF (2:1 and 4:1), and CS-CF under simulated sunlight irradiation. (c) Plots for TiO_2/CuS heterojunctions (2:1 and 4:1) under visible light irradiation. (d) Plots for TiO_2/CuS heterojunction-CF (3:1 and 4:1) and TiO_2/CuS heterojunction-PPNWF (3:1 and 4:1) under visible light irradiation.

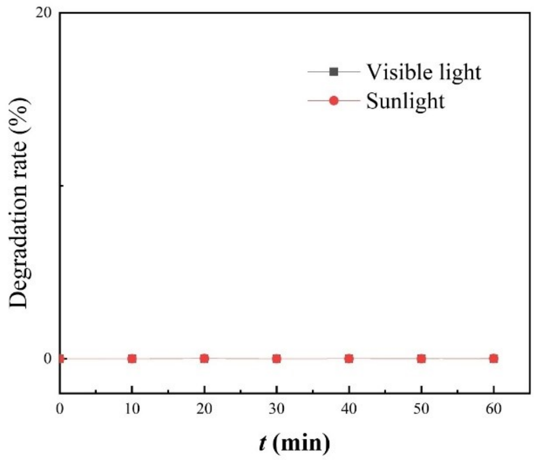

Figure S3. Blank control experiment. The self-degradation (photolysis) of the RhB dye was monitored under simulated sunlight and visible light irradiation without any catalyst.

Table S1. Changes in coating mass of CS/TiO_2-CF, CS/(TiO_2/CuS)-CF, and CS/(TiO_2/CuS)-PPNWF samples after five simulated washing cycles.

□	CS/(TiO_2/CuS)-CF (3:1)	CS/TiO_2-CF	CS/(TiO_2/CuS)-PPNWF (3:1)
Orinal Fabric Weight (mg)	1350	1350	205
Weight After Loading (mg)	1400.6	1419	250
Catalyst loading (mg)	50.6	69	45.3
Residual loading mass (Cycle 1, mg)	44	62.2	41.3
Residual loading mass (Cycle 2, mg)	33.4	49.3	28.3
Residual loading mass (Cycle 3, mg)	29.7	40.3	22.8
Residual loading mass (Cycle 4, mg)	27.9	38.5	20.8
Residual loading mass (Cycle 5, mg)	27.7	38.3	20.6
Coating loss rate after 5 washes (%)	45%	43%	54%

The coating retention rate (%) after the fifth washing cycle was calculated based on the mass values listed in Table S1. The positive correlation between the retained coating mass and the corresponding photocatalytic activities presented in the main text confirms the stability and durability of the heterojunction coatings on fabric substrates.

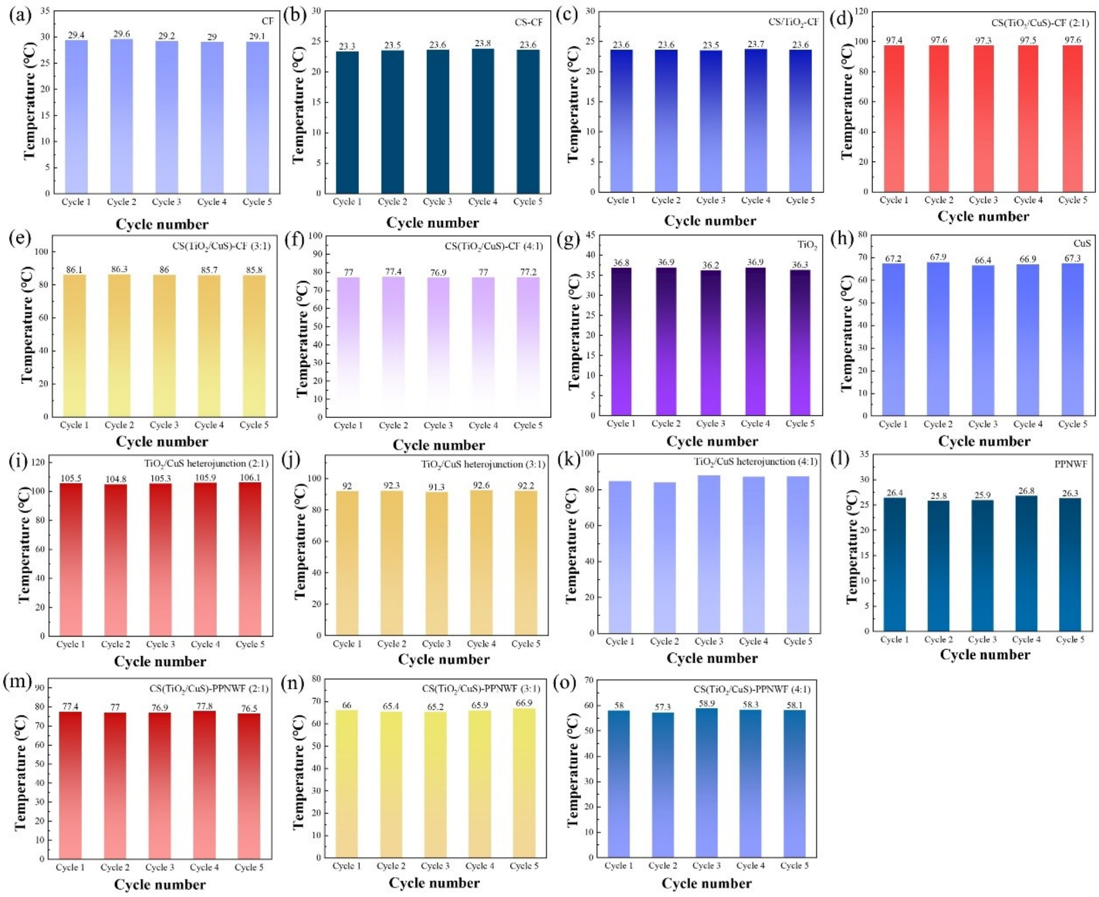

Figure S4. The photothermal on/off cycling stability (five cycles) of CF (a), CS-CF (b), CS/TiO_2-CF (c), CS/(TiO_2/CuS)-CF (2:1) (d), CS/(TiO_2/CuS)-CF (3:1) (e), CS/(TiO_2/CuS)-CF (4:1) (f), TiO_2 (g), CuS (h), TiO_2/CuS heterojunction (2:1) (i), TiO_2/CuS heterojunction (3:1) (j), TiO_2/CuS heterojunction (4:1) (k), PPNEF (l), CS/(TiO_2/CuS)-PPNWF (2:1) (m), CS/(TiO_2/CuS)-PPNWF (3:1) (n), CS/(TiO_2/CuS)-PPNWF (3:1) (o)

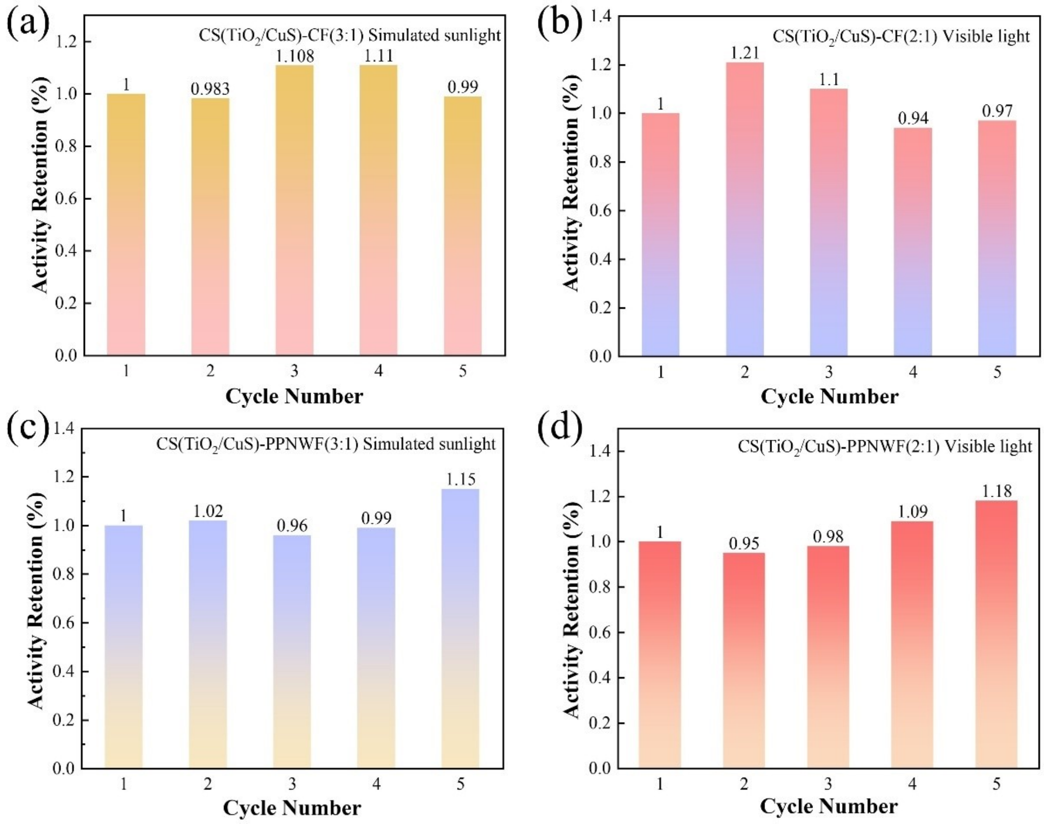

Figure S5. Reusability (cycling) tests of the photocatalytic fabrics. The fabric type and the type of photocatalyst are labeled in the figure.

Estimation of Catalyst Loading and Normalization of Rate Constants

Since the coating on the fabric contains both the photocatalyst and the chitosan binder, the total mass gain measured by gravimetric analysis does not directly represent the actual catalyst mass. To obtain a more accurate estimation of catalyst loading, we performed the following two control experiments:

Composition of the impregnation solution: The impregnation solution was prepared with a chitosan-to-photocatalyst mass ratio of 2:1, and the mixture was stirred thoroughly to ensure uniform dispersion.

Chitosan attachment behavior: Fabric samples were impregnated with a chitosan-only solution (at the same chitosan concentration as in the impregnation solution) to determine the average mass gain attributable to chitosan alone.

Based on these two sets of data, the proportion of catalyst in the total mass gain was estimated, and the actual catalyst mass on each fabric piece was calculated accordingly.

To eliminate the influence of varying catalyst loading on the comparison of photocatalytic activity, the reaction rate constants were normalized. The normalized rate constant (k_{norm}) was calculated using the Eq. S1:

$$k_{norm}=k/m_{cat} \quad (1)$$

where: k is the apparent first-order rate constant (in min^{-1}), obtained by linear fitting of $\ln(C_0/C)$ versus time t; m_{cat} is the estimated actual catalyst mass (in g); k_{norm} is the normalized rate constant (in $min^{-1} \bullet g^{-1}$).